



Life After Airliners

Part VII



**EAA AirVenture 2004
Oshkosh, Wisconsin
July 30, 2004**



Outline

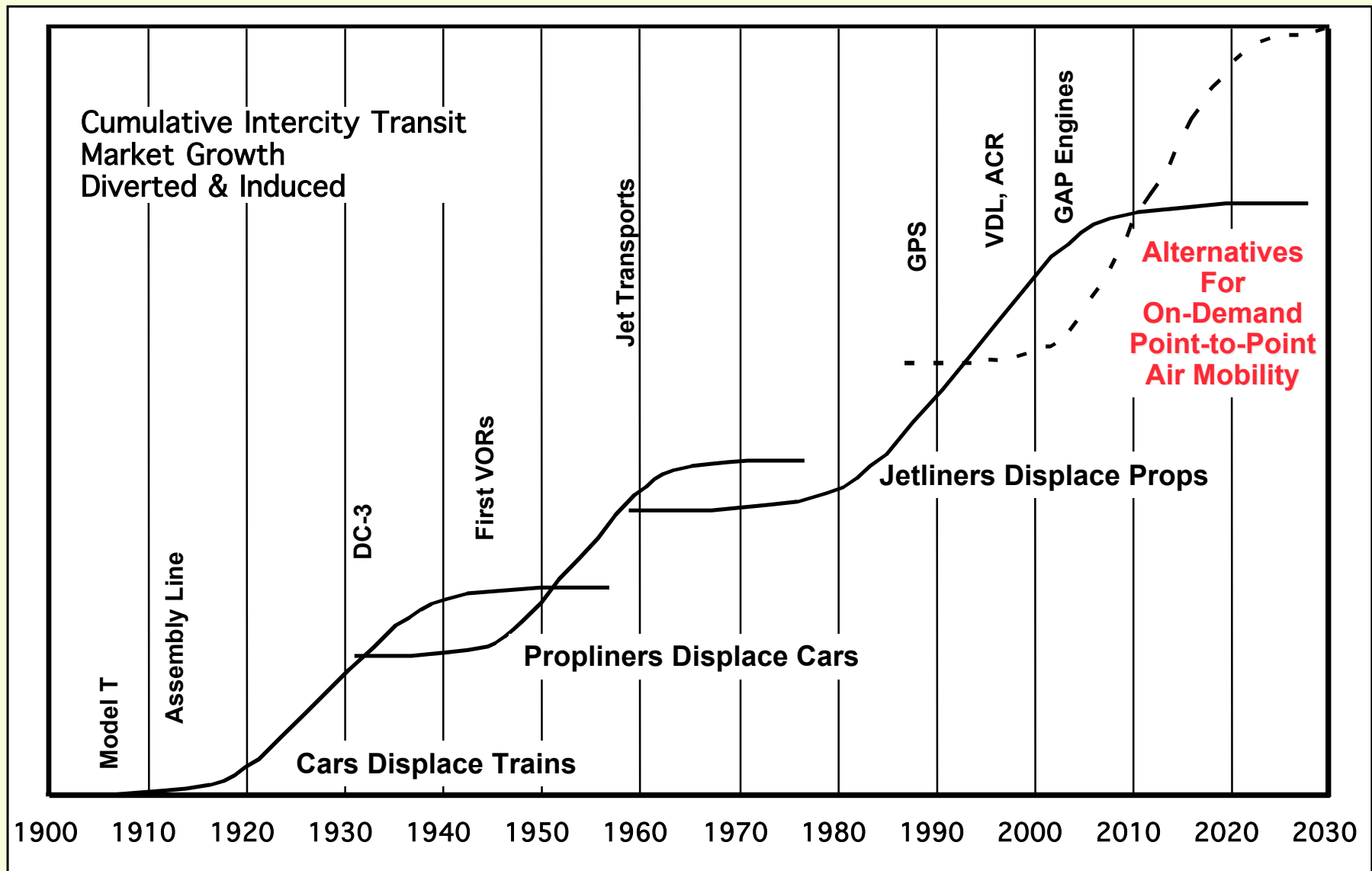
- Transformation is the Mission of early 21st Century Aeronautics
- The Worlds of 2025 Offer as Framework for Strategies
- Modern Network Theory Offers Ways to Think About What We're Transforming
- A Notional Technology Roadmap



*The Future is All Around Us
Our Job is to Spread It Around*

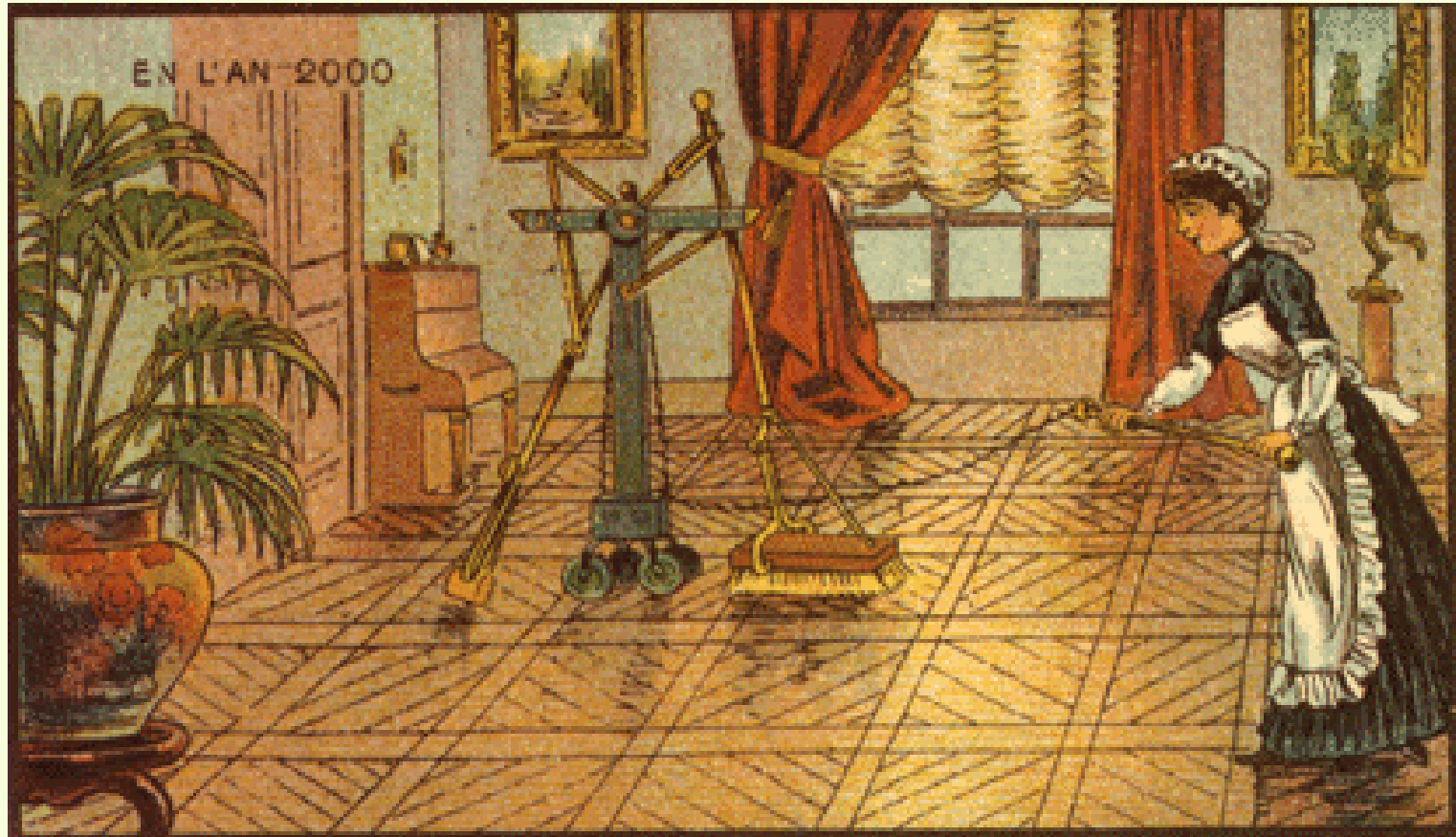


Notional Life Cycles in Transportation





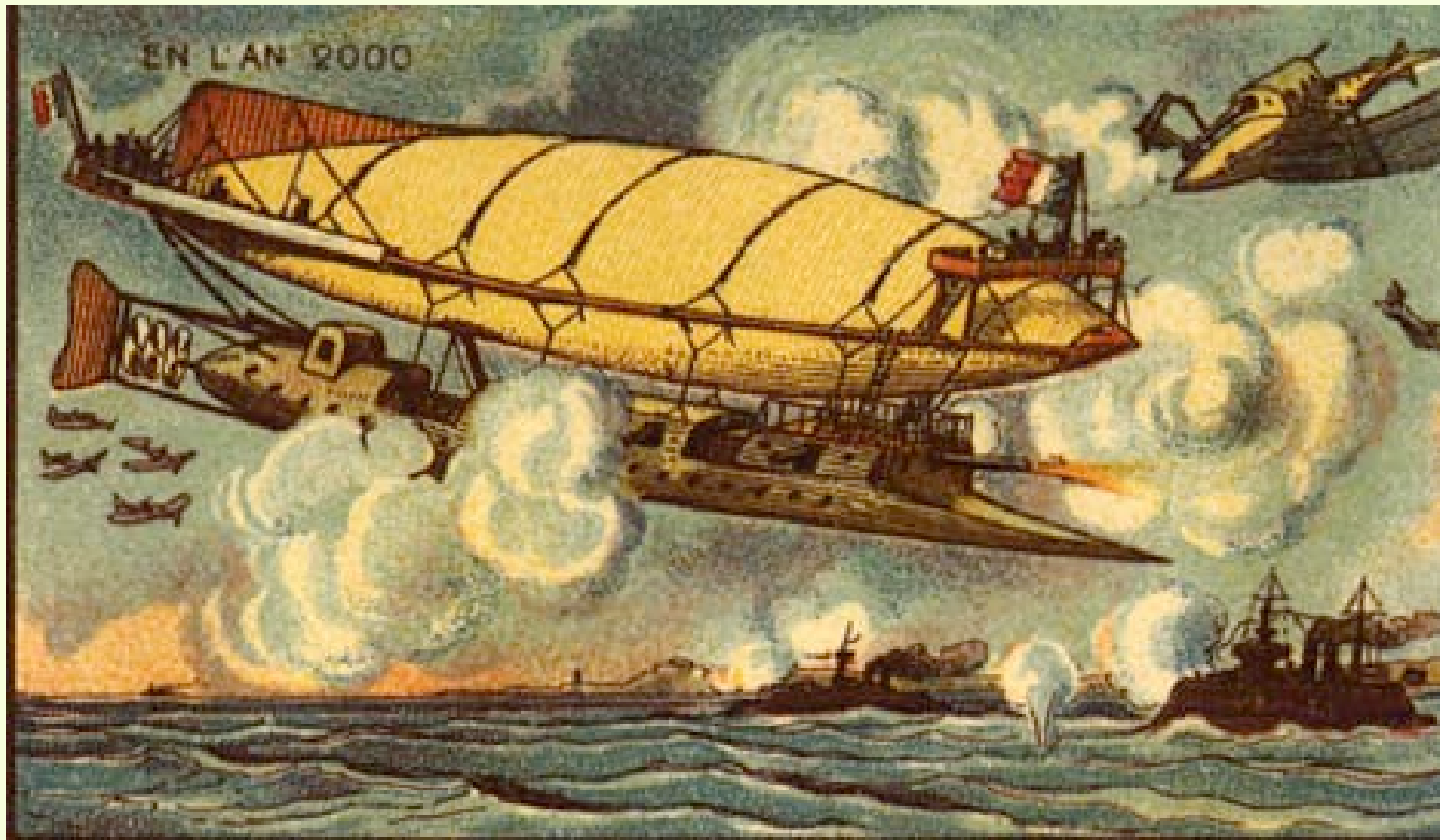
Electric Scrubbing



From *Futuredays* by Isaac Asimov
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An Aerial Battle



From *Futuredays* by Isaac Asimov
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A House Rolling Through the Countryside



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Heating with Radium



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Rules of the Game are Changing





Why Transformation?

- **The current aviation system does not scale to meet future needs related to***
 - ***Aircraft***
 - ***Airports***
 - ***Airspace***
 - ***Commerce and Business models***
 - ***Environmental considerations***
 - ***Security and safety considerations***
- **Current airspace evolution and modernization plans do not lead us to the changes needed beyond 2015**
- **Transformation requires change across government agencies**
- **The results of transformation produce new business models, new regulatory models, and new uses of airspace, airports, and aircraft**
- **The outcome of transformation is to enable scalability to meet the nation's needs in commerce, mobility, security , and safety**

****From NRC Report (2003) and the President's Commission Final Report (2002)***



The Notional Life Cycle of The Innovation Called Airline Travel





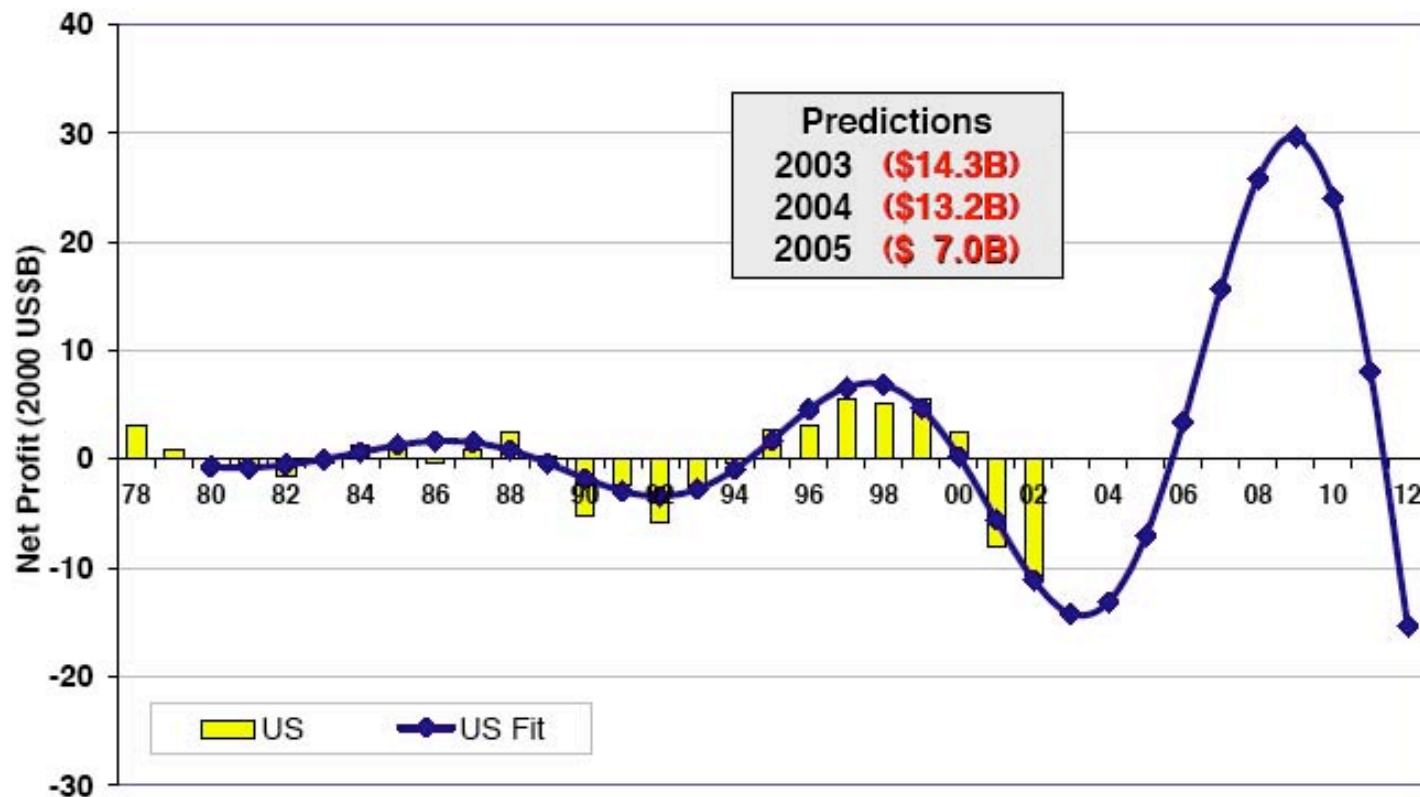
Whither or Wither?



US Airlines Net Profit Model - 2002

Best Fit of Undamped Oscillation

Cycle Period = 11.3 yr eFolding Time = 7.9 yr



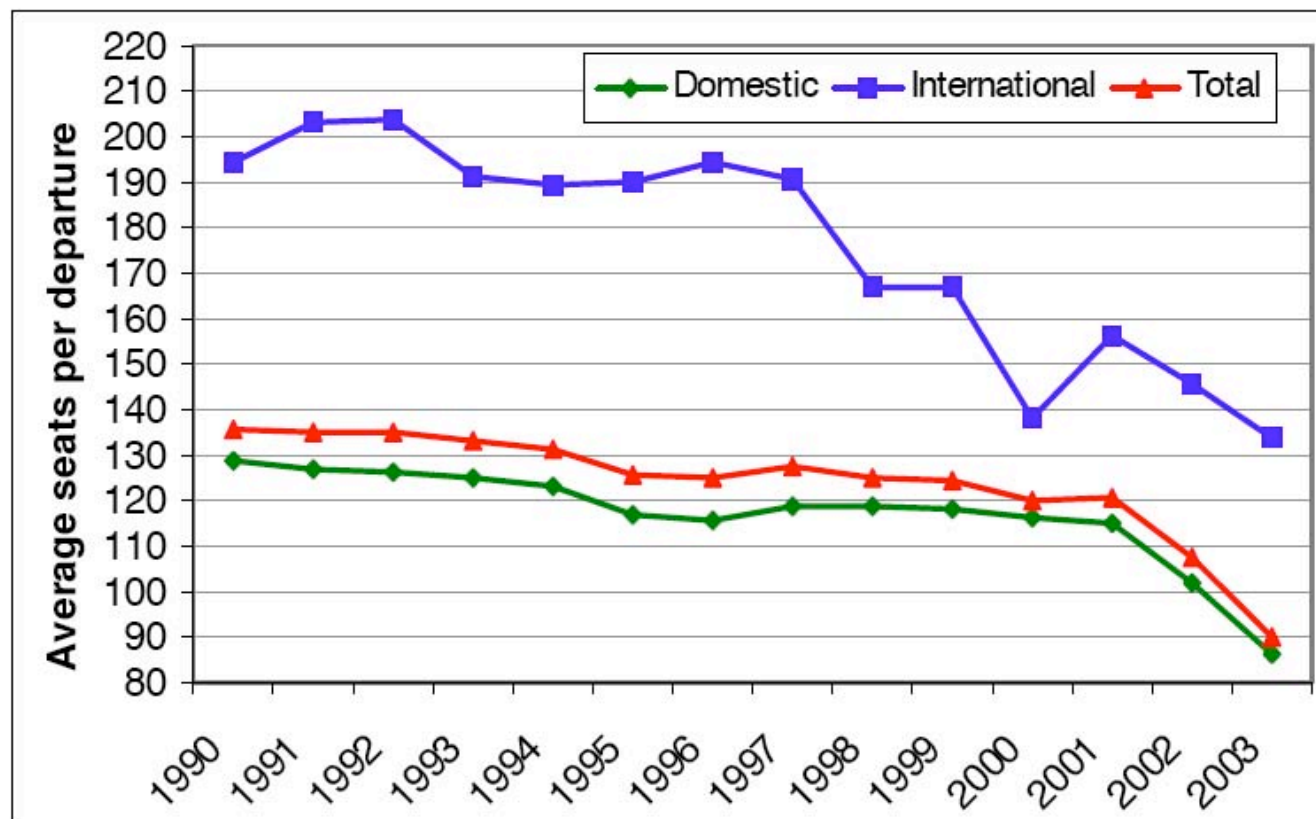
NB: Predictions are in constant 2000 dollars.



What's Really Happening Here?



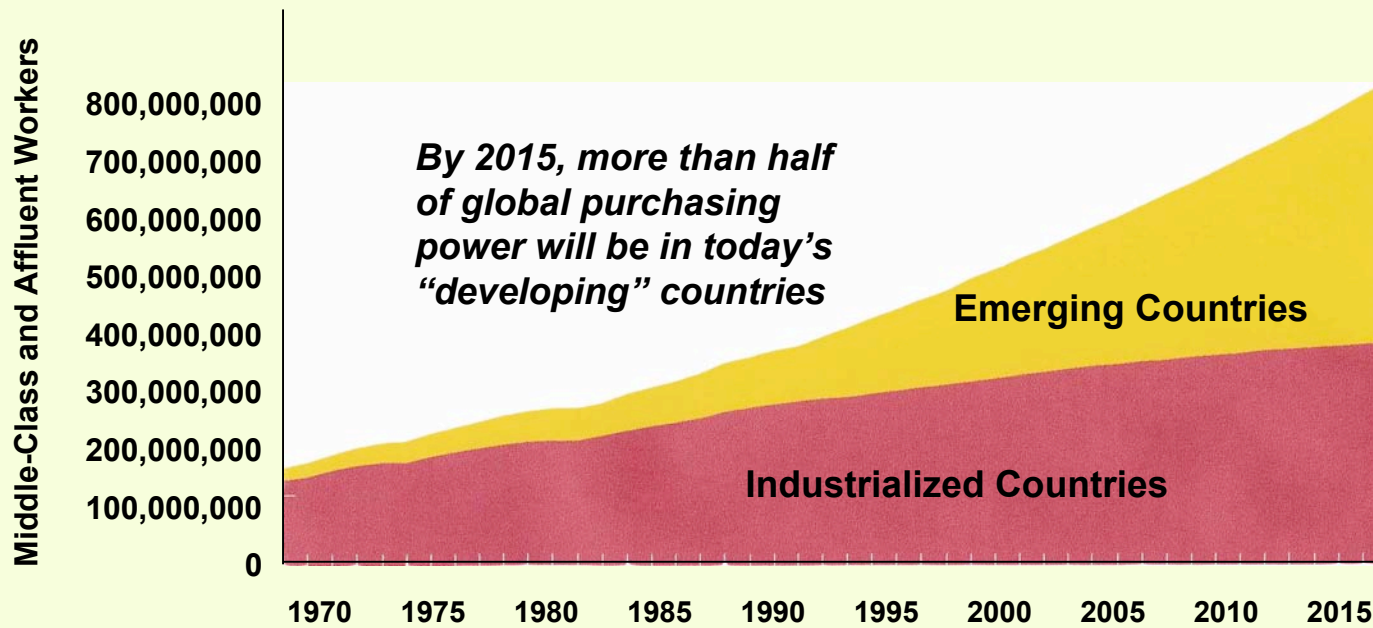
Trends in Aircraft Size



Data source: Form 41 Traffic data from Bureau of Transportation Statistics (includes Regional Jets and Turboprops)



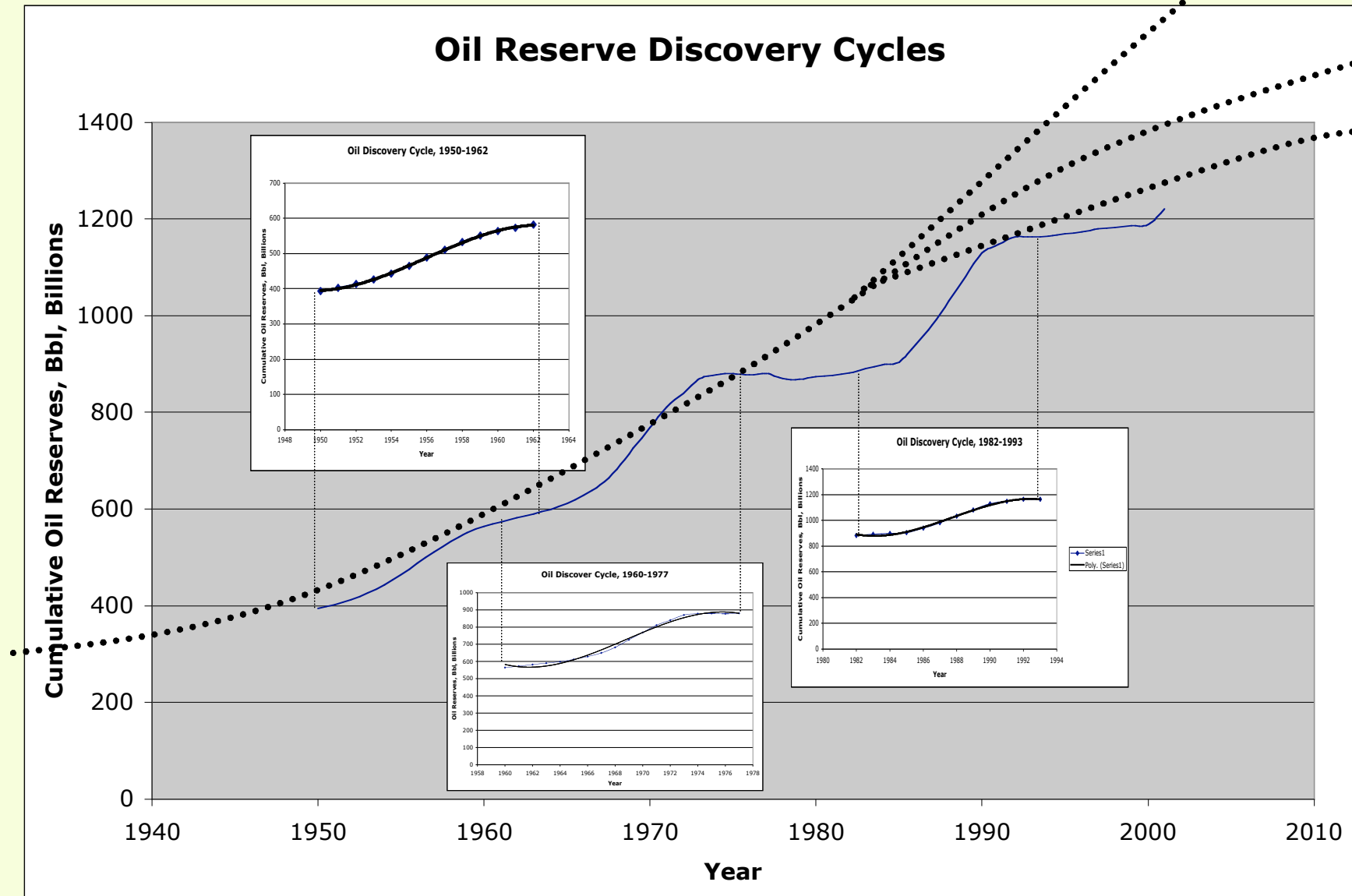
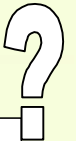
Tomorrow's Consumer Market





What's Going On with Oil?

What does the Big S-Curve look like?





***The pace of change in today's world
demands context-derived strategic thinking.***

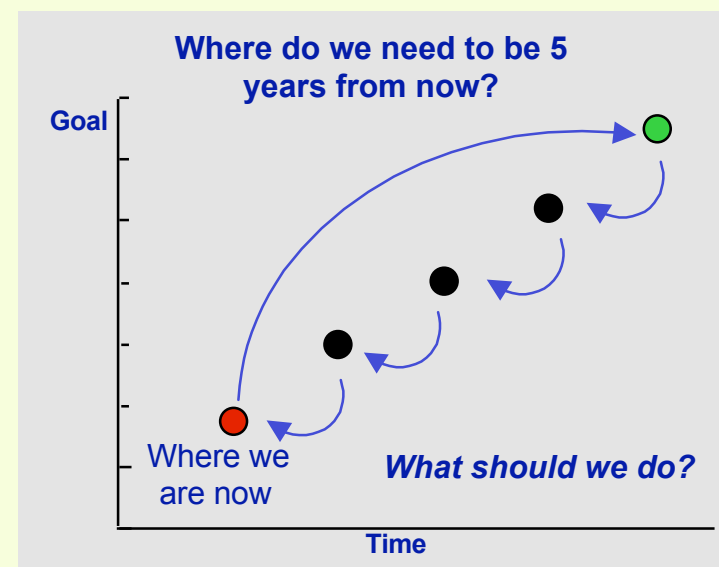
Incremental Execution

• Negotiation-Derived Strategies



Strategic Thinking

• Context-Derived Strategies



***Context-derived strategies create relentless execution toward a vision
And
Help avoid failures of imagination.***



Joint Planning and Development Office 2025 World Scenarios

JPDO Futures Working Group
Scenario Planning

Asia's Century

U.S. Economy	
Weak	

Summary

The U.S. in the year 2025 is a terror, but it has been a terror from other national problems, inadequately funded entitlement across the country, average it work hard — sometimes at the stagnation have taken a toll a global markets. China — and rapidly and developing into it is there where many of our

The Futures
STRATEGY GROUP

JPDO Futures Working Group
Scenario Planning

Is it hot in here or

U.S. Economy	
Weak	

Summary

It seems that just about every health conditions and painful are suffering around the globe. Sea waters are rising with the species are undergoing towards warming once-fertile lands have

In spite of the very real and pe respond with a slow and often damaging effects on the entire aggressive international policy environment, and it will take a

Economic conditions are part companies have claimed for y. Unfortunately no major success gotten so had that an international addressing the current global Organization (WTO) is setting

The Futures
STRATEGY GROUP

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Scenario Planning

Markets Rule

U.S. Economy	
Strong	

Summary

Nobody thought they'd be now today's breathless pace the up purchase whatever they want. Companies that were not able This frenetic pace has helped spread increasingly to Asia as already deteriorating in many in Asia. Asian individuals are dissatisfied when they can't. The return to back on the issues.

The Futures
STRATEGY GROUP

JPDO Futures Working Group
Scenario Planning

Storm Clouds

U.S. Economy	
Strong	

Summary

To an historian of the post-W very significant differences in globalization" has stalled. Its following a coup in South America of state-sponsored terrorism obvious feature of the world's greater European Union that American Free Market Alliance the Chinese Communist Alliance and the Southern Drag A China are deeply engaged in space, an arms race, and fight ways; however, governments

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Scenario Planning

Terror Uncontained

U.S. Economy	Pace of Globalization	Global Trend in Transportation Architecture	Impediments to Aviation Growth and Development
Weak	Decreasing	Diffused	Security-Driven

Summary

In 2023, the world economy is struggling with the consequences of repeated terrorist attacks. The actions of the United States in defending its perceived legitimate interests have alienated a large segment of the world community, and caused "the axis of evil" to be joined by a larger group of nations that are not actively opposed to the U.S., but are profoundly ambivalent about American power. The global economy has become far more regionalized, as security costs have dragged down global trade. The United States is not the only target of international terrorism, but it is the leading object of the hatred of Islamist groups. These are in turn not the only terrorist groups active in the world, but they are the most destructive and maintain the highest profile.

The world transportation system has been similarly hamstrung by higher costs, security fears, and regionalization, and has been the target of more than one terrorist action. Terrorism has not been stopped, nor has it even been contained.

The Futures
STRATEGY GROUP

Work as a set to define an environment for strategy synthesis



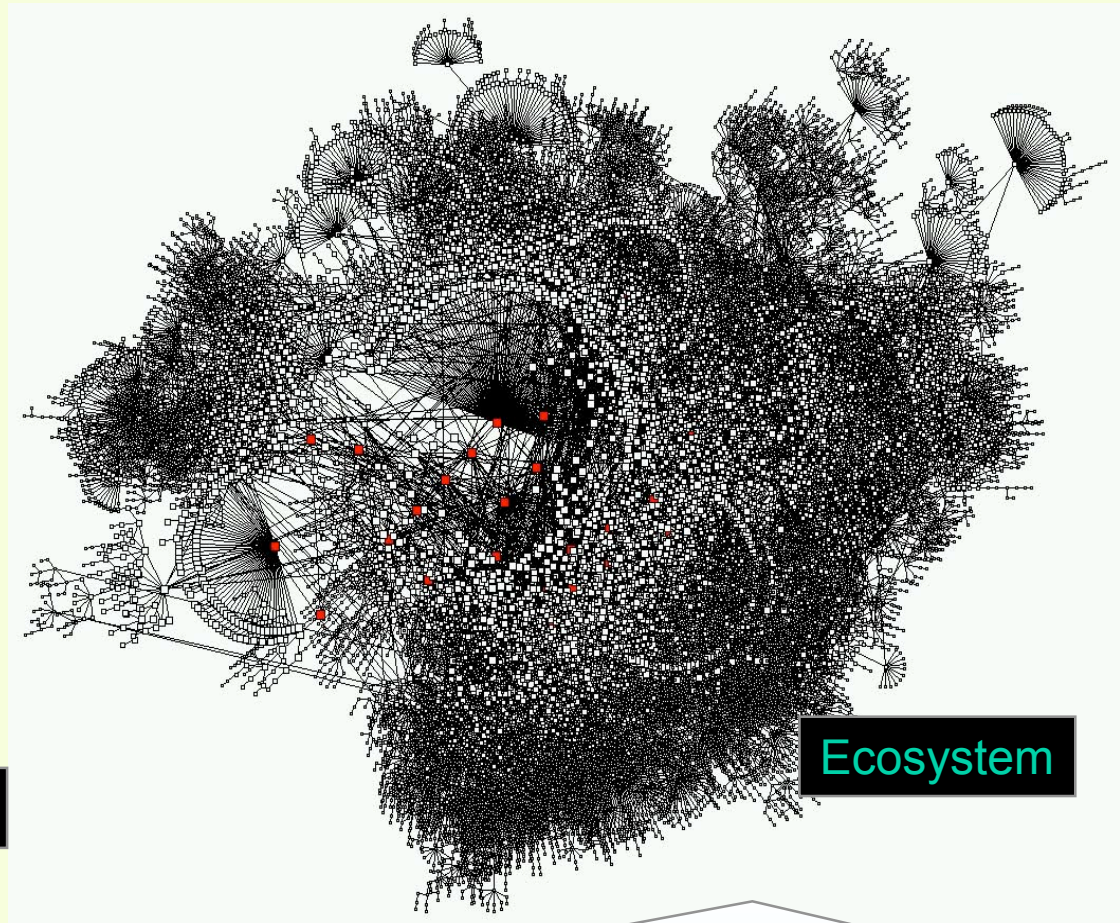
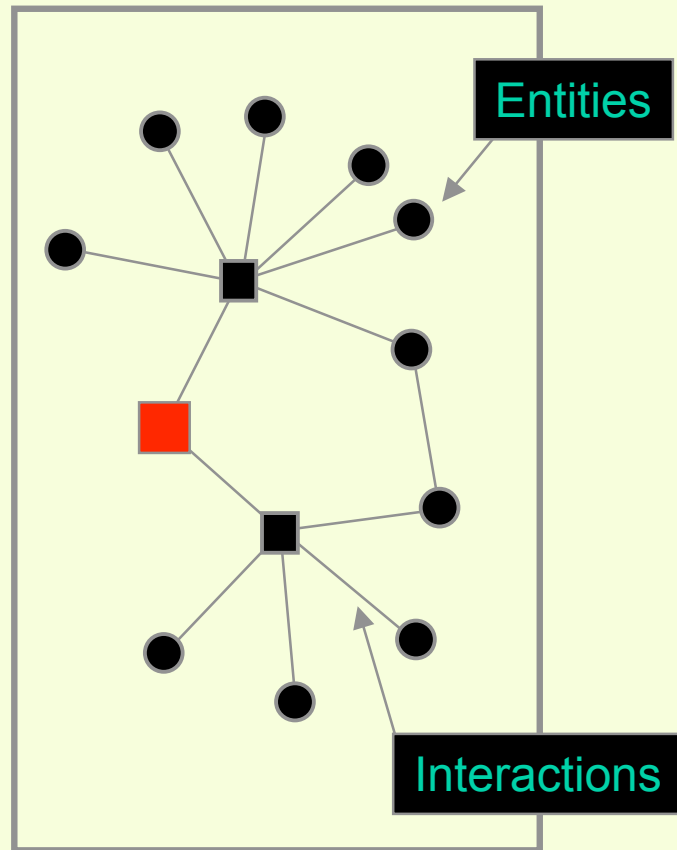
Technological Underpinnings for Mobility Alternatives

- ☐ 1. **Moore's Law**
on microprocessor cost/performance
- ☐ 2. **Gilder's Law**
on bandwidth performance
- ☐ 3. **Metcalf's Law**
on network performance
- ☐ 4. **The unwritten law**
of abundance
- ☐ 5. **The unwritten rule**
of gridlock
- ☐ 6. **Kurzweil's Law**
of Accelerating Returns
- ☐ 7. **The Golden Rule**
of the information age



An Ecosystem Illustrates The Need for Topology

(How to think about transformation)

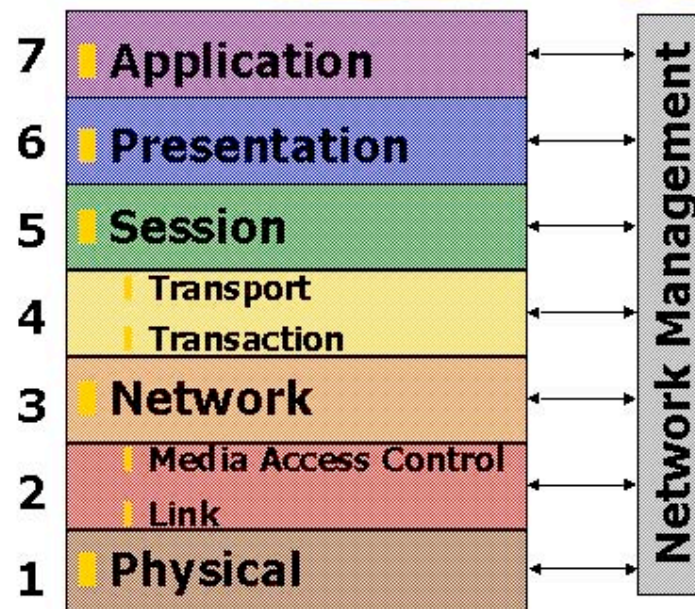


***“Laws of Form” lead to individual actions
that lead to the behavior of complex adaptive systems***



The ISO Stack

LonTalk ISO-Model Protocol Stack



10

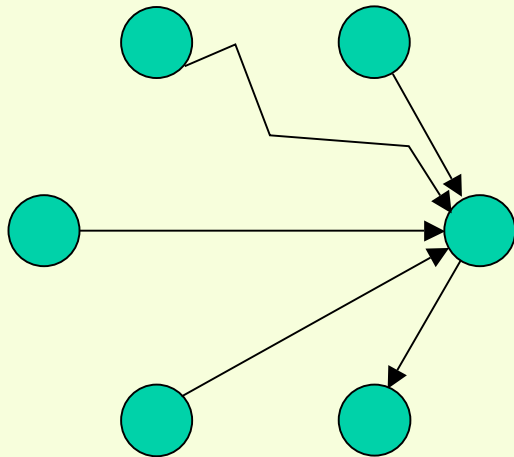
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As a metaphor for a transportation system topology



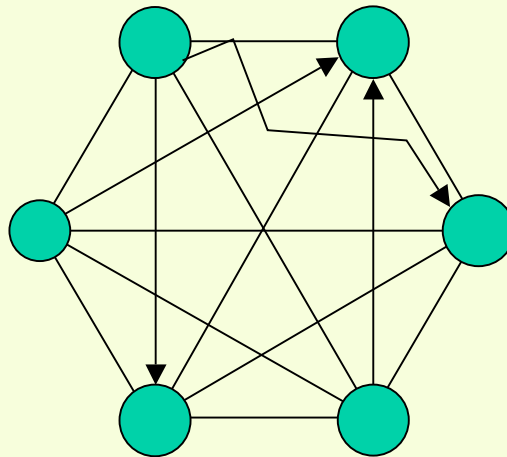
Value of Networks $\propto (\# \text{ of Nodes})^2$ (Metcalf's Law)

A. Hub-and-Spoke Directed, Scheduled, Aggregated



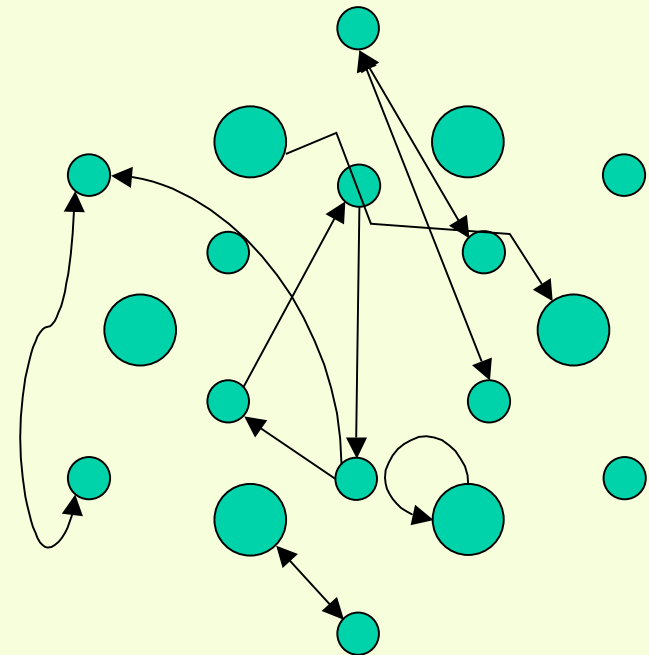
Nodes (n) = 6
Links (k) = $n-1 = 5$
Tier 1,2 Carriers

B. Point-to-Point Directed, Scheduled, Aggregated



Nodes (n) = 6
Links (k) = $n(n-1)/2 = 15$
Tier 2,3 Carriers

C. Distributed Undirected, On-Demand Dis-Aggregated



Nodes (n) = 18
Links (k) = $n(n-1)/2 = 153$
(Three times the nodes = 10X links)
Tier 4 Carriers, UAVs, RIAs, PAVs

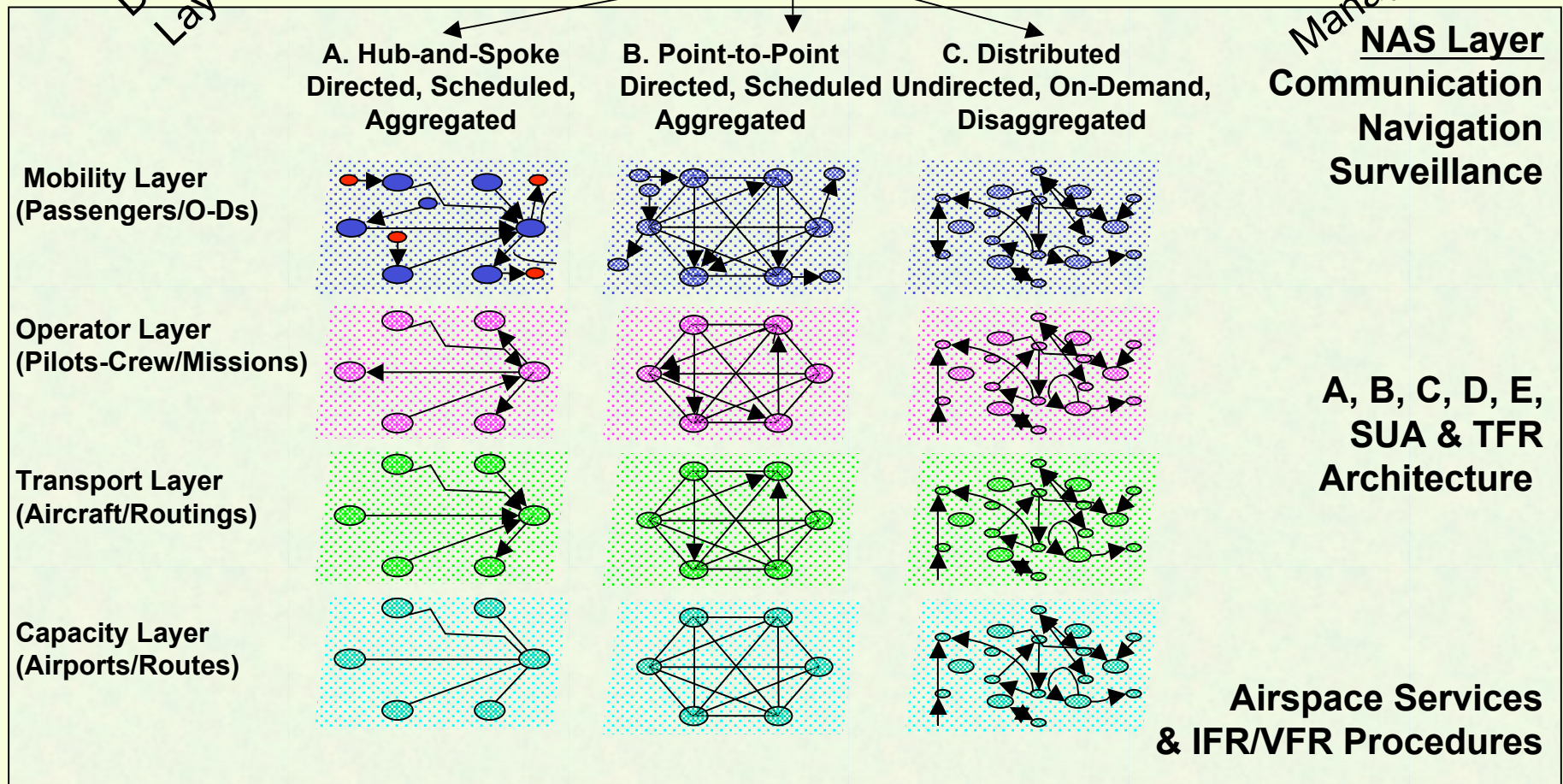


An Air Transportation Network Topology

Domain
Layers

Business Model Stacks

Network
Management

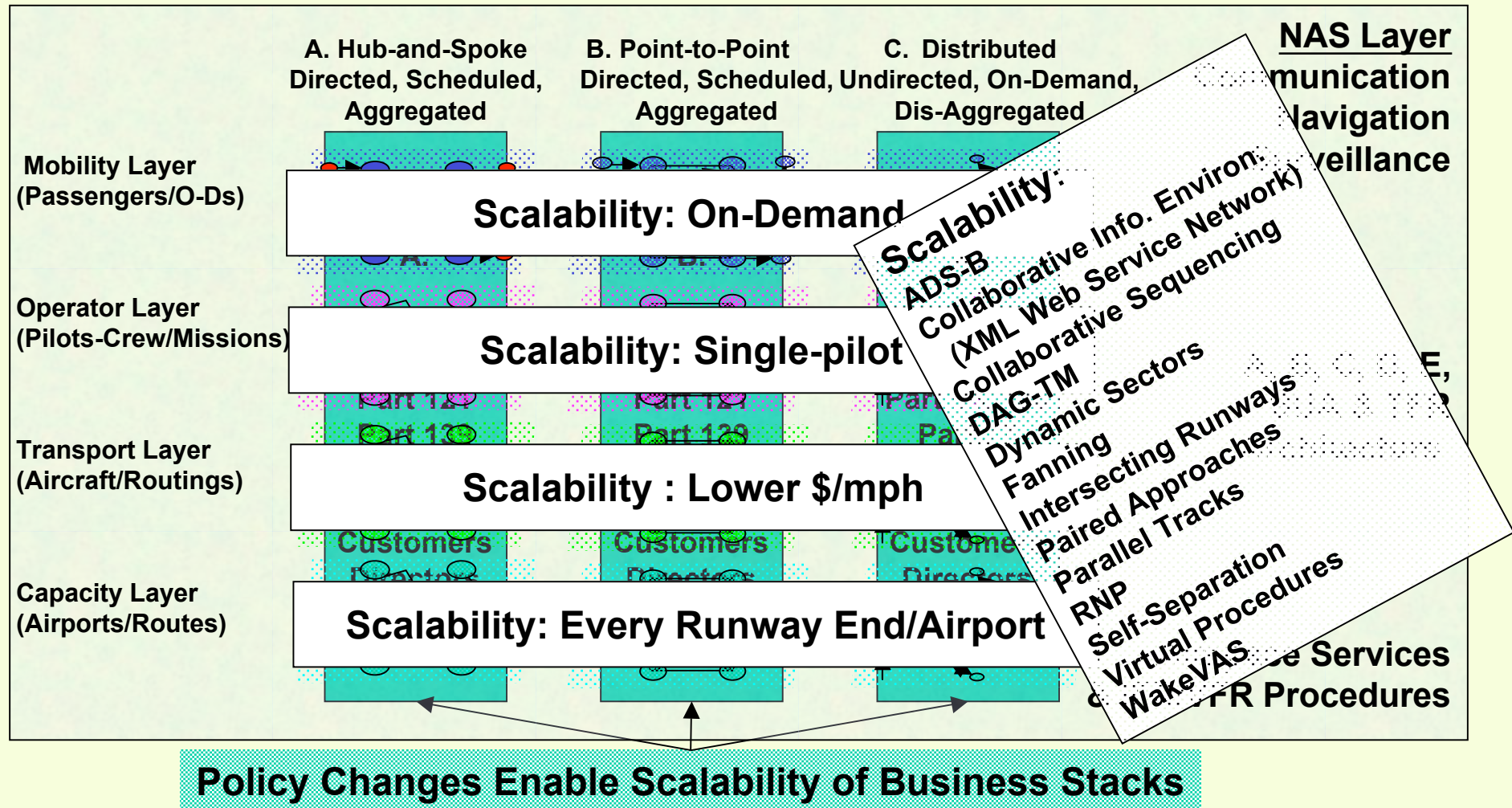


As a guide for HOW to think about transformation



Scalability for Air Transportation Networks

Q: What policy and technology strategies reduce the friction, or improve the impedance matching between the layers?





Transformation As a Campaign Against the 20th Century

System	20th Century	21st Century
Communication	Analog, Voice, Shared Frequencies	Digital, VXML, Addressable
Airport networks	Hub-and-Spoke	Widely Distributed
Air Traffic Services (Separation and Sequencing)	Ground-Centric	Airborne-Centric
Air Transportation Services	Scheduled	On-Demand
Air Crews	Two-Pilot	Single-Pilot Un-Piloted
Network Tools	Linear	Non-Linear
Cargo & Package Delivery	High-density markets, next-day service	Thin markets, same- day service
Economic Opportunity	Centralized	Diffused
Information	Compartmented	Integrated (for Aviator and Traveler functions)
System Responsiveness	Brittle	Resilient
System Growth	Constrained	Scalable (Up or Down)

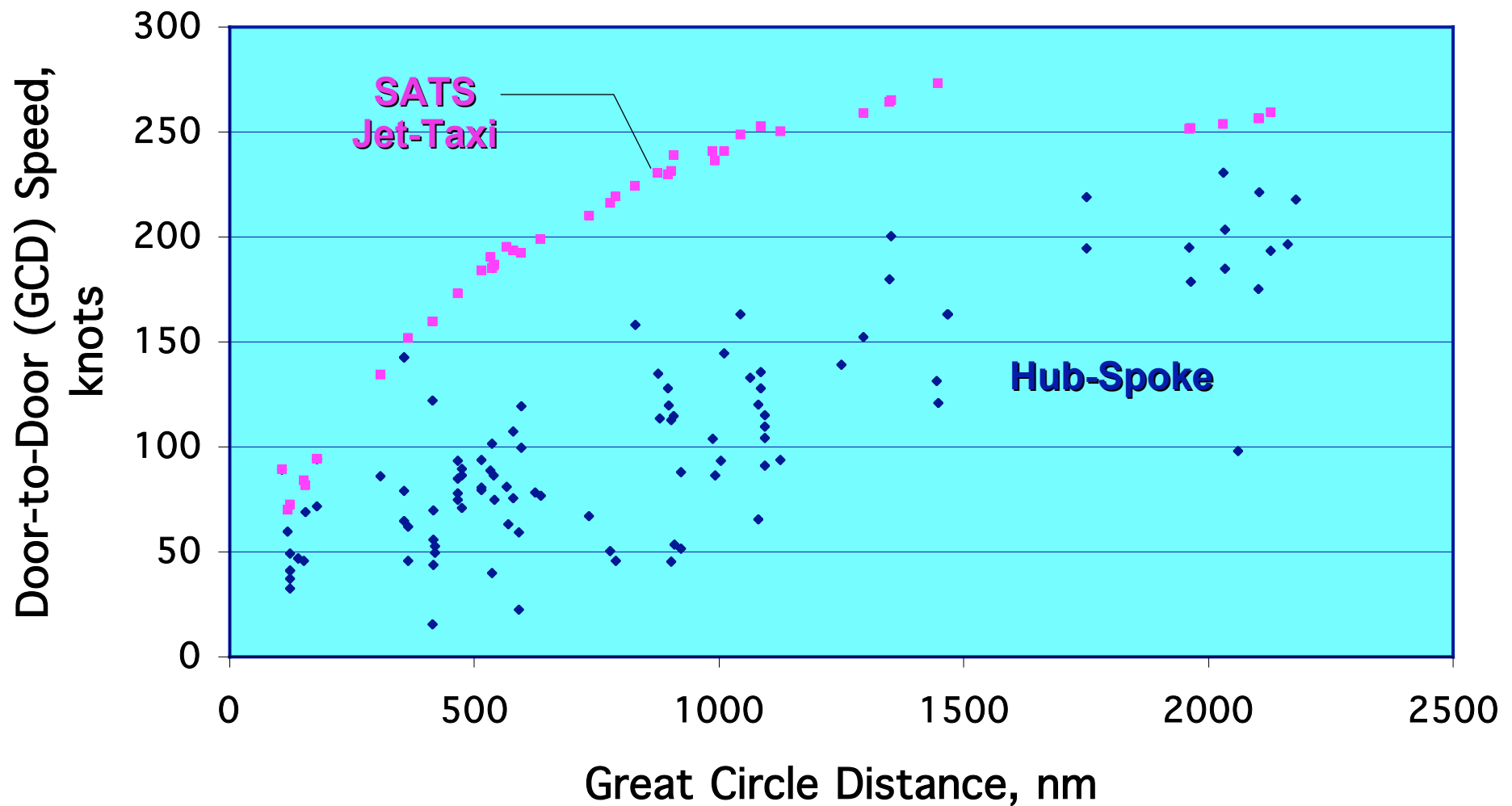


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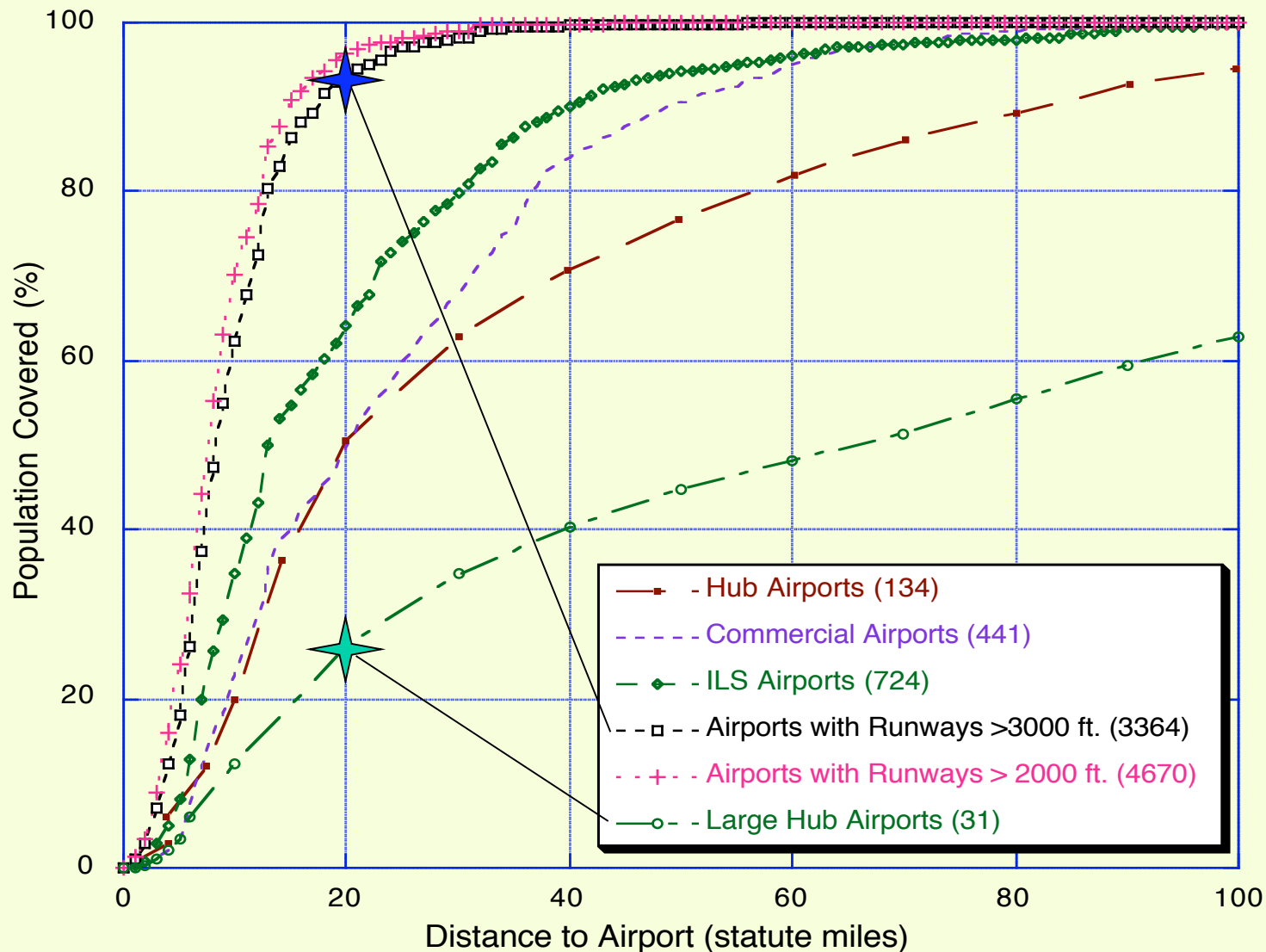


Comparison of Actual and Theoretical Speed of Doorstep-to-Destination Travel

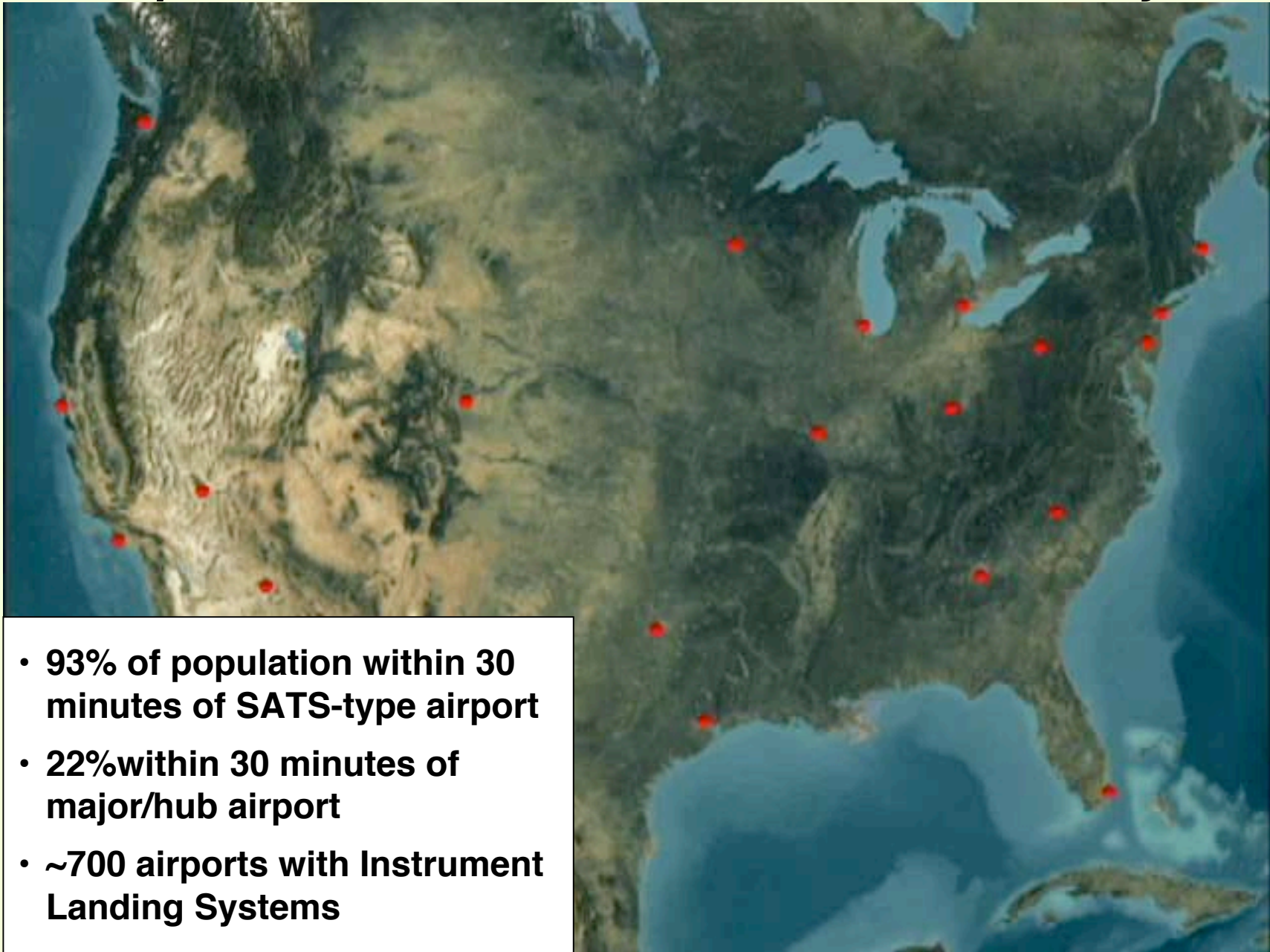




Airport Population Coverage Profiles (County Data 2000)



Equitable, On-Demand, Distributed Air Mobility





Reducing the Cost of Speed to More Places

Cirrus



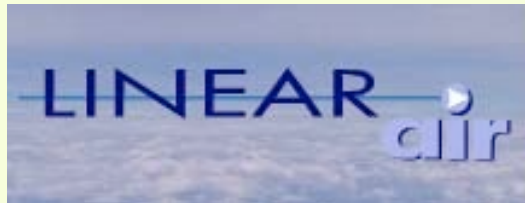
Lancair



Cessna Mustang



POGO Jets



Eclipse



Air Taxi
Distribution
Systems, Inc.

Adam Aircraft



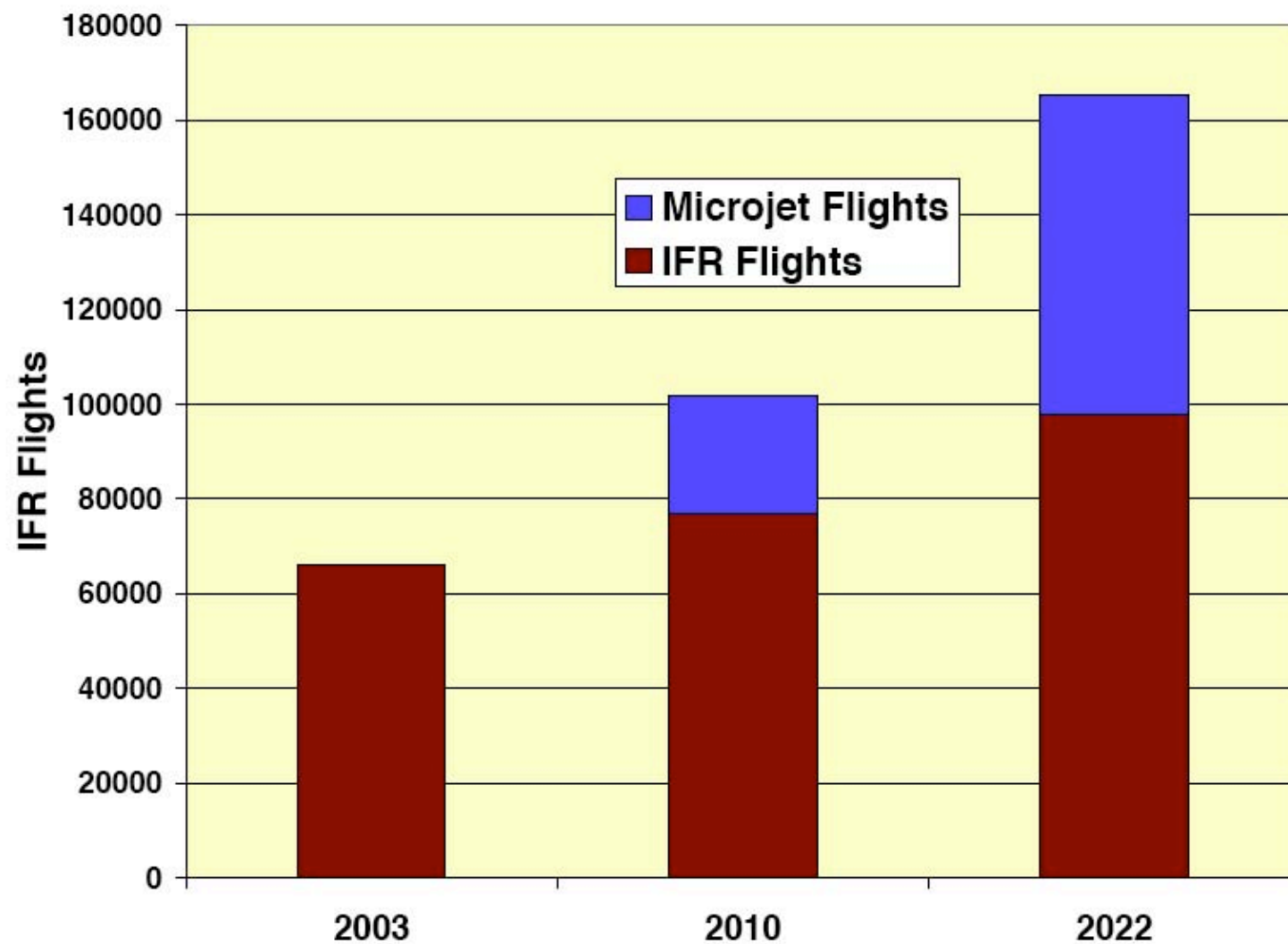
Watch This Space

Diamond





Is 3X (Capacity) Enough?





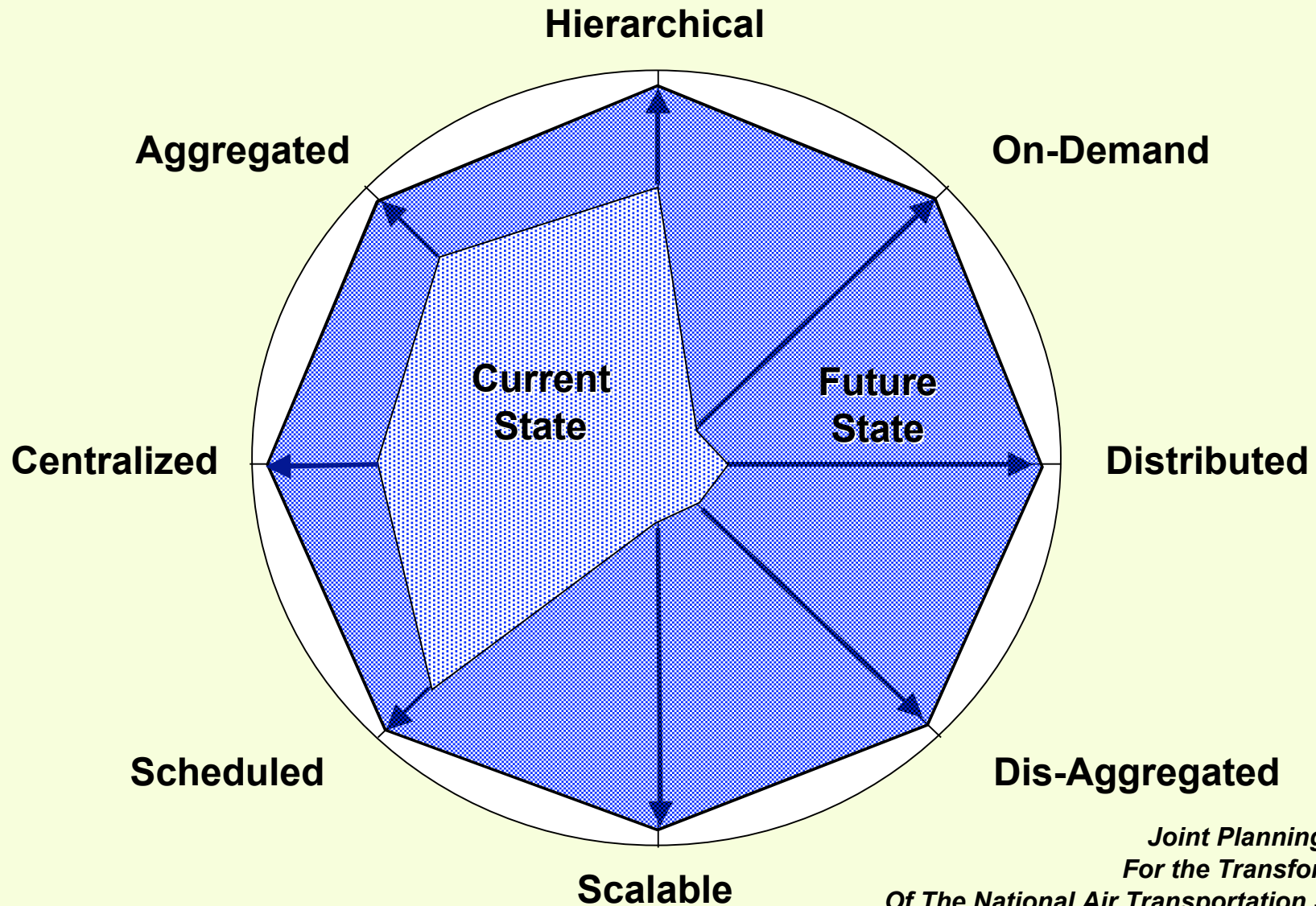
Strategies for Transformation

- A. Establish an agile air traffic management system to accommodate future demand**
- B. Establish a common operating picture**
- C. Develop a system-wide capability to dramatically reduce weather impacts**
- D. Plan for Origin-to-Destination Demand on a Regional Basis**
- E. Build resilience to disruptions**
- F. Ensure security without limiting mobility**
- G. Establish a National Air Transportation Enterprise**
- H. Lead the development of global air transportation standards, operations, and policies**
- I. Accelerate adoption of new technologies, policies, and procedures**
- J. Improve safety while introducing new capabilities and operations**
- K. Expedite environmental protections (technologies, policies & procedures)**

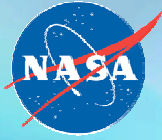


Transformation Concept Space (Notional)

The vision is to expand the concept space along *all* dimensions.



*Joint Planning Office
For the Transformation
Of The National Air Transportation System*

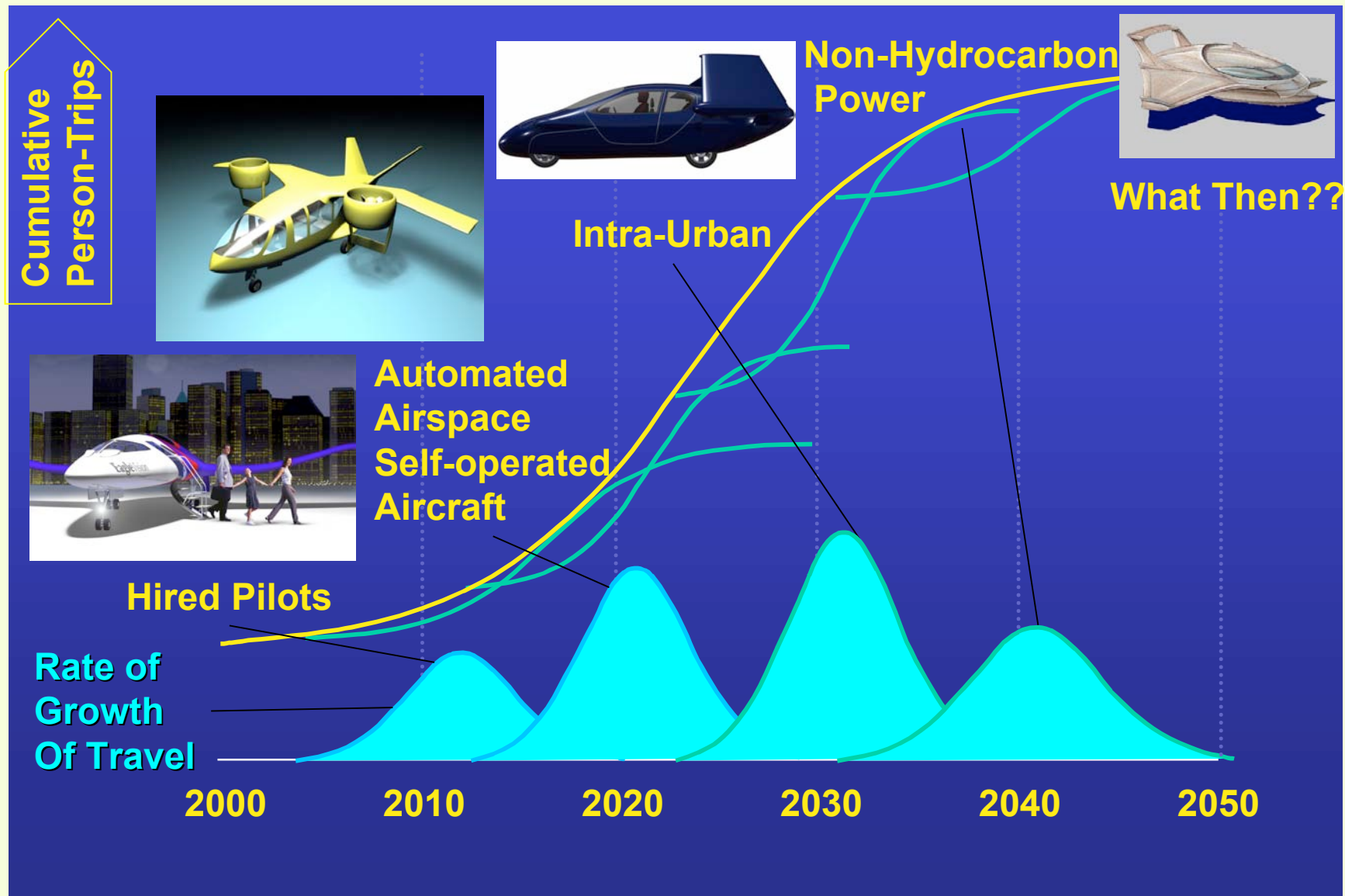


National Plan for the Transformation of the U.S. Air Transportation System

For More Information: <http://www.jpo.aero>



A Notional Life Cycle For Innovations in Air Mobility





Summary

- Transformation is the campaign of our era
- What we can learn from the worlds of 2025 is how to avoid failures of imagination
- A System-Level Topology For Air Transportation Provides a Tool for How To Think About What We're Transforming
- A Technology Roadmap For Air Mobility Offers A Framework for Technology Strategies



**Rehearse the Future
Avoid Failures of Imagination
Transform**

From 20th Century Wheels on America to 21st Century Wings on America

